PB88-243258

Review of the Alternative Technologies Research Program

(U.S.) Environmental Protection Agency
Washington, DC

18 Sep 86

U.S. Department of Commerce
National Technical Information Service
NTIS

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. SAB-EEC-86-025	2.	3. PB88-243258
4. Title and Subtitle: Review of the Alternative Technologies Research Program			5. Report Date: Sept. 18, 1986
			6.
7. Author(s): Environmental Engineering Committee			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: Environmental Protection Agency, Science Advisory Board, 499 S. Capitol Street, SW, Washington, D.C. 20460 (A101F)			10. Project/Task/Work Unit No.
			11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address: Environmental Protection Agency, 401 M Street, SW, Washington, D.C. 20460 (A101)			13. Type of Report & Period Covered: Final Report
			14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

As part of a process for reviewing EPA research programs, the Committee was requested to conduct a review of the Alternative Technologies Research Program at the EPA Hazardous Waste Engineering Research Laboratory (HWERL) in Cincinnati. This broad review concentrated on the Program goals and progress in meeting those goals, on the relevance and responsiveness to needs of the Agency's regulatory programs, and on the relationship of the Program to other research being conducted in ORD, elsewhere in EPA and outside of EPA.

17. Document Analysis a. Descriptors

Environmental Engineering Committee

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages: 14
	20. Security Class (This Page)	22. Price

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 19 1986

OFFICE OF
THE ADMINISTRATOR

Honorable Lee M. Thomas
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Thomas:

The Environmental Engineering Committee of the Science Advisory Board has recently completed a review of the Agency's Alternative Technologies Research Program, as a part of its ongoing quarterly reviews of EPA research programs. We are pleased to submit the Committee's report for your information.

The Committee finds that the Alternative Technologies Research Program is well-conceived, balanced and cohesive, and meets the relevant needs of the regulatory program in the Office of Solid Waste and Emergency Response.

We recommend that the waste minimization component of the Program be strengthened, that the process for selecting technologies for evaluation be reviewed, and that consideration be given to streamlining the permitting process for the Office of Research and Development test program.

We appreciate the opportunity to conduct this review, and we would be happy to discuss it further with you. We would appreciate a formal response to the conclusions and recommendations presented in the report.

Sincerely,

Raymond C. Loehr, Chairman
Environmental Engineering Committee

Norton Nelson, Chairman
Science Advisory Board

cc: A. James Barnes
Terry Yosie
Don Ehreth
John Skinner
Tom Hauser

SAB-EEC-86-025

Review Of The Alternative Technologies Research Program

Report Of

The Environmental Engineering Committee

U.S. Environmental Protection Agency
Science Advisory Board
Washington, D.C.

July, 1986

NOTICE

This report has been written as part of the activities of the Environmental Protection Agency's Congressionally established Science Advisory Board, a public group providing extramural advice on scientific issues. The Board is structured to provide a balanced, independent, expert assessment of scientific issues it reviews, and hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal Government.

Table of Contents

I. EXECUTIVE SUMMARY 1

II. INTRODUCTION 3

III. REPORT ON THE ALTERNATIVE TECHNOLOGIES RESEARCH PROGRAM REVIEW

A. Overview of the Alternative Technologies Program

1. Program Management 3

2. Additional Research Needs Not Currently Met 4

3. Relationship of the HWERL Program to Other Research . 5

B. Review of Specific Programs

1. Technology Assessment 5

2. Solidification/Stabilization 7

3. Emerging Technologies 8

4. Waste Minimization 9

5. Information Dissemination 10

IV. APPENDICES

A. Charge to the Committee

B. Roster of Committee Members Conducting the Review

Reproduced from
best available copy.

1. EXECUTIVE SUMMARY

As a part of a process for reviewing EPA research programs initiated in 1985 by the Science Advisory Board and the Office of Research and Development, (ORD), the Environmental Engineering Committee of the Science Advisory Board has recently completed a review of the Alternative Technologies Research Program at the EPA Hazardous Waste Engineering Research Laboratory (HWERL) in Cincinnati. This broad review concentrated on the Program goals and progress in meeting those goals, on the relevance and responsiveness to needs of the Agency's regulatory programs, and on the relationship of the Program to other research being conducted in ORD elsewhere in EPA and outside of EPA. The charge to the Committee is presented in Appendix A, and the members of the review Subcommittee are identified in Appendix B.

The Committee's principal findings and recommendations are highlighted in the following summary:

A. In general, the Committee finds that the Alternative Technologies Research Program is well-conceived, balanced and cohesive, and meets the relevant needs of the regulatory program in the EPA Office of Solid Waste and Emergency Response.

B. The Alternative Technologies Research Program is primarily oriented towards RCRA-related research, not all of which is applicable to CERCLA (and particularly not to problems CERCLA will face as a result of the RCRA land-banning decisions). The CERCLA portion of the program should be designed to address these gaps.

C. The Committee recommends that the waste minimization component of the program be significantly strengthened, especially to include establishing a formal network between industry, academia, and government to share successful strategies, practices, data, and programs. More emphasis should be placed on the reduction or elimination (as a result of process changes or product formulations) of the generation of hazardous wastes.

D. HWERL should establish formal coordination of this program with research done elsewhere in EPA, in contrast to the current informal approach.

E. ORD should review the choices for evaluating existing technologies/processes for the treatment of wastes which are to be banned from land disposal under the 1984 RCRA amendments (now generally referred to as the hazardous and solid waste amendments - HSWA) to be sure that potentially significant processes have not been overlooked (such as biological treatment of aqueous organic liquids, steam stripping of wastewaters, and treatment of residuals from solvent recovery). HWERL should convene a small panel of experts to assist in these judgments.

F. The Committee recommends a review of the costs associated with the operation of EPA's mobile treatment equipment. At present, based on data made available to the Committee, these costs seem high.

G. EPA should consider how to streamline and accelerate the permitting process for the ORD test program to facilitate a more timely response to regulatory needs.

H. The issuance of the Technical Resource Document on Solidification/Stabilization, now scheduled for June, 1989, should be accelerated. Evaluations of this technology are greatly needed in the field.

I. We recommend an expanded in-house research program, including solidification/stabilization. This will provide valuable hands-on experience to HWERL staff, and aid it in selecting and managing larger extramural projects.

J. HWERL should establish a more systematic and logical process for selecting emerging technologies to be supported, and the Committee will be pleased to comment on it when developed.

K. ORD should establish a mechanism by which basic research needs identified by HWERL can be directly supported.

Reproduced from best available copy.

II. INTRODUCTION

At the request of the Agency's Office of Research and Development, the Science Advisory Board has agreed to conduct a series of reviews on a number of ongoing research programs within the Agency. The reviews are being coordinated under the auspices of the SAB's Subcommittee on Strategic and Long-Term Research Planning. Their purpose is the peer review of ongoing research programs by panels of recognized experts in order to communicate to the Agency the progress, or lack thereof, being made in meeting research needs pertinent to the development of Agency regulations and policy.

As one of the reviews requested for FY 1986, the Environmental Engineering Committee was asked to review the Alternative Technologies Research Program at the Hazardous Waste Engineering Research Laboratory (HWERL) in Cincinnati. The other component of this program, dioxin research, was addressed in a previous SAB review.[1]

A Subcommittee of the Environmental Engineering Committee (see roster, Appendix B) conducted the review on June 24-25, 1986, at the HWERL. At this time, the Subcommittee was briefed by Dr. Thomas Hauser, Director, and by members of the HWERL staff.

Prior to the meeting, the Subcommittee received a comprehensive program summary document from HWERL. The Subcommittee also received, at the meeting, a proposed 60-Test Matrix for field evaluations of alternative technologies, information on the DOD/EPA Working Group to Explore Hazardous Waste Cleanup Demonstrations, and a sample of the test plan and facility test report for a typical evaluation.

The Subcommittee was pleased with the completeness and frankness of the HWERL staff presentations. The EPA staff was forthright about information gaps, problems and needs. Despite the restricted time available for the review, the Subcommittee believes that it obtained a relatively clear understanding of the current status of the EPA Alternative Technologies Research Program.

The Subcommittee drafted this report, which was then reviewed and approved by the entire Environmental Engineering Committee at a meeting on July 23-24, 1986, prior to submission and approval by the SAB Executive Committee.

III. REPORT ON THE ALTERNATIVE TECHNOLOGIES RESEARCH PROGRAM REVIEW

A. Overview of the Alternative Technologies Program

1. Program Management

The Alternative Technologies Research Program provides support to a number of offices in the Agency, primarily the Office of Solid Waste (OSW). Approximately 88% of the program resources (if CERCLA

1 "Review of the Status of Dioxin Research in the United States Environmental Protection Agency," Dioxin Research Review Subcommittee, Science Advisory Board, U.S. EPA, January, 1986 (SAB Report No. SAB-EC-86-011).

resources are included, and 82%, if not) are concentrated on the identification and evaluation of alternatives to the land disposal of hazardous wastes. Although some CERCLA resources have been included in the Program plan, it must be emphasized that this RCRA-oriented research will primarily provide information about technology performance which is applicable to RCRA wastes, and will not totally define the applicability of the technology to the treatment of CERCLA wastes or to the problems CERCLA will face as a result of the RCRA land-banning decisions. The remainder of the Program is divided between research on waste minimization and information dissemination.

Program priorities are established by ORD through the research committees and with extensive consultation with Agency staff. The priorities are largely determined by the provision of and schedule imposed by the HSWA, and by the needs of OSW. This is the reason performance evaluation of alternate technologies is emphasized. Overall Program management rests in the Office of Environmental Engineering Technology (OEET), and the Program is centered at HWERL in Cincinnati.

The HWERL Briefing Document does not make clear how systematic judgments are made on selecting alternative technologies to be evaluated for use with certain hazardous waste categories, or how decisions are made about which promising technologies are supported by the emerging technologies research component.

The Subcommittee suggests that HWERL continue to strengthen its peer review process.

The HWERL in-house research should be expanded so that HWERL staff will have "hands-on" personal experience with the technologies being evaluated and can effectively assess their performance with specific hazardous wastes.

2. Additional Research Needs Not Currently Met

The Program generally provides good coverage for the full range of technologies that are available. Research on waste minimization has been concentrated on reuse and recovery, and not on actual minimization of the original generation of wastes. This latter component of the Program should be strengthened.

HWERL has planned 60 tests and evaluations of existing or available processes on certain combinations of technologies and waste categories. The Subcommittee recommends that HWERL consider additional test combinations, as specified later in this report.

The limitation on available R & D resources is recognized. The Committee recommends, however, that additional expenditures for waste minimization and/or performance evaluation be made, even at the expense of other Program elements.

3. Relationship of the HWERL Program to Other Research

The Committee has concerns about the degree to which the HWERL Alternative Technologies Research Program is coordinated with research done elsewhere in EPA, as well as outside the Agency. While there were some formal efforts, such as the DOE/DOD/EPA Working Group, heavy reliance is placed on reviews of the literature and on personal knowledge. Discussion with the HWERL staff on this point confirmed that informal contacts with the scientific community, and even with foreign research programs, is good. The Committee recommends that more formal coordination efforts be established.

B. Review of Specific Programs

The Alternative Technologies Research Program has five major components: technology assessment, solidification/stabilization, waste minimization, emerging technologies, and the information dissemination. Each of these is briefly described below, together with the Committee's comments on each component.

1. Technology Assessment

This portion of the Program consists of a series of in-house and extramural projects to evaluate the information available on the use of various existing processes for the treatment of wastes if they are banned from land disposal under the recent RCRA amendments. The projects concentrated initially on waste types and technologies specified largely by OSW. Major elements of this portion of the Program include performance evaluations of alternative treatment processes, characterization of treatment residuals and demonstration/evaluation projects.

The Technology Assessment component is considered to be the "heart" of the Alternative Technologies Research Program. We recommend that this activity be continued.

The ORD staff is engaged in developing and providing data for use by the OSW staff in drafting regulations that relate to the land banning provisions in the HSWA. The ORD staff attempts to evaluate and demonstrate those unit separation operations and treatment processes that are applicable to specific waste streams in order to convert those streams into materials that are safe to landfill and/or to dispose of in an environmentally sound manner.

The ORD program consists of performance evaluations conducted at pilot-scale and field assessment levels. OSW will use the results of these evaluations to establish "best demonstrated available technologies" (BDAT) for specific waste streams that are uniform in nature. HWERL has the ability to conduct about sixty assessments in the next four years. This has resulted in process selections that may have caused the omission of more significant BDAT choices. For example, metal-bearing aqueous wastes will only be subjected to one test by one process. Biological treatment processes for aqueous organic liquids, steam stripping of wastewaters, and residuals from solvent recovery will not be field tested at all. These choices need to be reviewed carefully to ensure that potentially significant processes have not been overlooked. For example, certain waste streams, with concentrations of organics greater than 1%, should be readily treatable by anaerobic processes.

Within the time provided for the discussions, the decision-making process by which: a) some waste streams are to be treated by several unit processes and others by only one, b) the omission of certain unit processes from consideration, such as reverse osmosis and solvent extraction, and c) the number and extent of tests, was not fully rationalized to the satisfaction of the Committee. We recognize that some of the technologies will be assessed by pilot-plant testing.

The Committee suggests that HWERL canvass a small panel of experts to assure that it assesses the best processes for the specific waste streams in order to verify and/or modify present ORD decisions.

The type of tests utilized will be based upon "steady-state" conditions. The Committee has concerns about this emphasis since it also is important to obtain data on residuals, emissions and performance under non-steady state conditions. Transient conditions, such as start-ups and shut-downs, and excursions, should be taken into consideration in developing the data base. In other words, HWERL should address the reliability of long-term operations and the stability of the process in developing a data base for regulatory purposes. Operating reliability will not only affect the quality of the main waste stream, but also the quality of the residuals.

The Committee was surprised at the $150,000 per week operating costs of the mobile equipment which was cited. The reason for, and components of, these costs were not obvious. We suggest a review of these costs.

The Committee recommends that the permitting process for the ORD test program be further streamlined and accelerated to facilitate the program and ensure a more timely response to statutory deadlines of the HSWA. Delays experienced under the current system may be a constraint on conducting evaluations of alternative technologies.

The Administrator should also recognize that the present Program is designed primarily to meet RCRA land banning deadlines for about 400 uniform waste streams. There are references to CERCLA in the material reviewed, and although some of the BDAT information will have relevance to some CERCLA problems, these wastes by their heterogeneity and varying levels of cross-contamination of waste streams will require a separate effort over and above this program to assist the Superfund program in meeting the land banning deadlines.

The technology assessments obtain information on the liquid, gaseous and solid (residual) emissions from the treatment process(es). We a) agree that information on characteristics of these emissions should be obtained as part of these assessments, and b) recommend that the effort to thoroughly understand the cross-media implications of these technologies continue to receive a high priority as the test plans for these assessments are developed. Within the resources available for an assessment, all emissions should be characterized as thoroughly as possible.

2. Solidification/Stabilization

The solidification/stabilization (S/S) component of the program concentrates on the characterization of wastes and binders, the performance evaluation of S/S technologies, and a field verification effort. The budget summary provided the Subcommittee showed a split under RCRA in FY 86 of 1 to 13 between the first two elements. The Committee believes that EPA should place more emphasis on understanding chemical interactions. A better balance is planned in FY 87 and 88, and should be maintained that way.

Sizeable studies of immobilization technology are also planned as part of the CERCLA-related effort. At the time of this review, these studies were not as well described as those for the RCRA program, and could not be reviewed. When such descriptions are available, the Committee would be interested in receiving them for possible comment.

We note that it is particularly important in the S/S area to maintain very close contact with sizeable parallel efforts at the DOE National Laboratories, and within DOD.

Having started in 1975, S/S is a more mature area of research at the Cincinnati facility than are the other components of the Alternative Technologies Program. While early efforts seemed to overemphasize macroencapsulation and the use of asphaltics, the current project mix is consistent with regulatory support needs, both in the short and long term.

We recommend that a modest in-house laboratory program be initiated in the S/S area. The hands-on experience gained would aid the staff in selecting and managing larger extramural projects.

Reproduced from best available copy.

The briefing document concludes that examination of solidified/stabilized waste disposed of several years ago probably would not be an adequate data source for future improved S/S processes. We do not agree, and believe that examination of such long-buried wastes would be worthwhile; positive results would be directly meaningful, and negative results would help identify problems. We recommend that HWERL consider such an examination.

3. Emerging Technologies

The Emerging Technology component is designed to provide new options for treating hazardous wastes. This component emphasizes: a) filling gaps in waste technology needs, b) assisting regions and states in decisions regarding treatment alternatives, permits, and remedial actions, and c) continuing the development of specific technologies. The three research program areas discussed were physical/chemical treatment, chemical dehalogenation/ detoxification, and biological treatment. This part of the Program has 25-30% of the financial resources of the Alternative Technologies Program and is an important component of the overall Program.

We find the current emerging technology topics and projects are relevant to the needs of the regulatory program, and sense that competent scientific and engineering knowledge were used in arriving at the topics and projects that HWERL supports. However, it was not clear how the specific projects and topics were chosen. In addition, it was not clear that HWERL uses a systematic procedure to choose future topics for emerging technology support. Time may not have permitted adequate discussion of the logic for these choices. We suggest that there be an identified, specific logic framework available to document the decision-making process, and would be interested in commenting on it if the HWERL so desires.

The Alternative Technologies Program should have several major components for maximum effectiveness. These include basic research, development of emerging technologies, and assessments of developed and available technologies. HWERL clearly has activity in the latter two areas, but does not now have, nor have access to, any basic research component. Such a component is important and necessary if there is to be a flow of improved technologies deemed worthy of development and, subsequently, possibly worthy of pilot- or full-scale assessment. For its current research program, HWERL needs more information about a technology to show the likelihood of feasibility before support is provided through the emerging technologies and technology assessment programs.

The existing basic research program in EPA is the exploratory grants program supported by the Office of Exploratory Research (OER) in ORD. There is not a satisfactory mechanism by which the basic research needs identified by HWERL can be supported through OER. OER grant support is determined by peer review panels that properly focus on the quality of proposals submitted by independent researchers for possible support. Program relevance suggestions are considered when grant decisions are made; however such suggestions are not a major factor in the decision process. We, therefore, recommend that ORD develop a mechanism to provide direct support for basic research projects that HWERL justifies are needed for the success of the Alternative Technologies Program. This support should be available through and to HWERL, and not through another ORD office.

The Committee also believes that the emphasis placed on assisting states and regions in decisions about hazardous waste management technologies is correct and constitutes an important aspect of the HWERL Program. We recommend that EPA continue such an emphasis.

4. Waste Minimization

This portion of the Program, the smallest of the five, is directed primarily at the documentation of current industry practices at existing waste treatment and reuse facilities, and the collection of design, cost, and waste treatability data.

We are aware of the tendency for the allocation of research funds to follow the requirements of legislation. This is the case in the waste minimization program as only 4% of the total budget is allocated to this important issue. We recommend that EPA increase funding for waste minimization efforts and that ORD expand the program to include evaluations in the area of process changes and material substitutions.

Although the HSWA remain silent on the subject of costs, OSW and ORD are to be commended for including cost data into their decision-making process.

The basic approach to waste minimization as outlined in the briefing document includes recovery/reuse, process changes and material substitution. However, the six case studies completed or in progress are all related to recovery/reuse, and generally deal with wastes already produced. In practice, true minimization should begin to reduce or eliminate the generation of hazardous wastes through process changes and material substitutions (including product reformulations). More recognition is needed of the fact that hazardous wastes also are generated from the use and disposal of finished products. Product reformulation represents the only way to minimize the hazardous wastes from the finished product. A focus on the

process change and material substitution possibilities will provide a more balanced and cost effective approach to the current waste minimization program area.

We recommend that ORD take a lead role in establishing a formal network among academia, industry, government and trade associations for the collection and sharing of successful waste minimization data, strategies, widely applicable operations and processes, and programs. Presently, it appears that the majority of information related to successful waste minimization programs are passed by word of mouth, and no formal process of information dissemination exists. This network could begin by convening a well-publicized meeting of interested parties. The Tufts annual conference is a big step in this direction, but it is limited to a small number of individuals and cannot reach all of those capable of contributing information on waste minimization. ORD needs to clearly identify industrial groups or companies that have made advances in waste minimization, and to take a leadership role in this area.

The waste reduction audit procedure initiated by HWERL could become an excellent management tool capable of achieving significant reductions in waste generation. We suggest that ORD first place major emphasis on establishing the credibility of the audit model, focusing on demonstrated, practical, successful experiences or strategies that show real dollar savings. Once credibility has been established, the model will be the incentive for other firms, including smaller businesses, to minimize wastes.

5. Information Dissemination

This component includes the production of a series of technical resource documents summarizing the results of ongoing projects, the conducting of symposia and training seminars, and the development of a data management system to provide project information to EPA Regions and to state regulatory authorities. Approximately 3 1/2% of program resources (if both RCRA and CERCLA funding are included) are devoted to this effort.

The technical resource documents (TRD's) produced are directed at meeting deadlines imposed by the HSWA. The TRD on solidification/stabilization should be accelerated given its importance and applicability to both RCRA and CERCLA wastes.

HWERL staff are conducting a series of state-of-the-art seminars, and also provide R/D permit support and assist with workshops conducted by the EPA Center for Research Information (CERI). While this is a reasonable effort, the Committee believes that state-of-the-art seminars are the most valuable means for exchanging information, and provide an important link between the knowledge obtained and its practical application. They should be expanded.

HWERL has done a commendable job in sponsoring an annual hazardous waste symposium during the past 12 years. This symposium is a nationally-recognized event that has attracted an increasing number of attendees (> 1200 in 1986), and we believe that it should be continued.

The proposed activities, which include preparation of documents on ongoing project results, conducting periodic training seminars, and meeting with regional/state regulatory authorities on the use of the documents, represent positive steps. The current funding seems adequate to achieve the intended objectives. Since this is a reletively new Program, the effectiveness of the activities proposed in this area should be carefully monitored and timely adjustments made as needed to assure a cost-effective activity that is responsive to Program needs.

APPENDIX A

Environmental Engineering Committee
Science Advisory Board
U.S. Environmental Protection Agency

ALTERNATIVE TECHNOLOGIES RESEARCH REVIEW

Charge to the Committee

I. To perform a broad review of the HWERL Alternative Technologies Research Program.

II. To evaluate the Program goals, cohesiveness and balance.

III. To evaluate Program progress in meeting stated goals.

IV. To evaluate the relevance of the Program to the needs of the Agency regulatory programs.

V. To examine the relationship of the Program to related research being done in other ORD Laboratories, elsewhere in EPA, and outside of EPA.

VI. To identify research needs not currently being met.

APPENDIX B

Environmental Engineering Committee
Science Advisory Board
U.S. Environmental Protection Agency

ALTERNATIVE TECHNOLOGIES RESEARCH REVIEW SUBCOMMITTEE

Chairman

Dr. Raymond C. Loehr
Department of Civil Engineering
University of Texas
Austin, Texas

Members

Dr. Joseph T. Ling
3M Corporation
Minneapolis, Minnesota

Mr. Richard Conway
Union Carbide Corporation
South Charleston, West Virginia

Mr. George Green
Public Service Company of Colorado
Littleton, Colorado

Mr. Allen Cywin
Consultant
Alexandria, Virginia

Dr. Ben Ewing
University of Illinois
Urbana, Illinois

Executive Secretary

Mr. Harry C. Torno
Science Advisory Board
U.S. Environmental Protection Agency
Washington, D.C.